Kinematics Review - Vectors intro

Homework from last class:

P304
Q~~18~~ 16

$V = \frac{1}{2} V_0$ at $x = ?$

$\frac{V_0}{2} = V_0 \cos \omega t$

$\frac{1}{2} = \cos \omega t$

$\frac{\pi}{3} = \omega t$

$\frac{\pi}{3} = 2\pi f t$

$\frac{1}{6} = f t \qquad f = \frac{1}{T}$

$\frac{1}{6} T = t$

$t = \frac{\pi}{3}$

$$x = x_0 \sin\frac{\pi}{3} = \frac{\sqrt{3}}{2} \times x_0$$

or $V_0 = \omega x_0$

$$\pm\omega\sqrt{x_0^2 - x^2} = v$$

Total Energy $= \frac{1}{2} k x_0^2$

$$E_K = \frac{1}{2} k x_0^2 - \frac{1}{2} k x^2$$

$$\frac{1}{2} m v^2 = \frac{1}{2} k \left(x_0^2 - x^2\right)$$

$$v^2 = \frac{k}{m}\left(x_0^2 - x^2\right)$$

$$v = \sqrt{\frac{k}{m}}\sqrt{\left(x_0^2 - x^2\right)}$$

$$v = \pm\omega\sqrt{x_0^2 - x^2}$$

$$v = \omega x_{11}$$

$$\frac{1}{2} v x_0 = v\sqrt{x_0^2 - x^2}$$

$$\frac{x_0^2}{4} = x_0^2 - x^2$$

$$x^2 = \frac{3x_0^2}{4}$$

$$x = \frac{\sqrt{3}}{2} x_0$$

$$a_0 = \omega^2 x_0$$

$$F = kx = ma$$

$$\omega = \sqrt{\frac{k}{m}} \qquad a = \frac{k}{m} x$$

$\frac{1}{2} a$ at $\frac{1}{2} x$ — linear

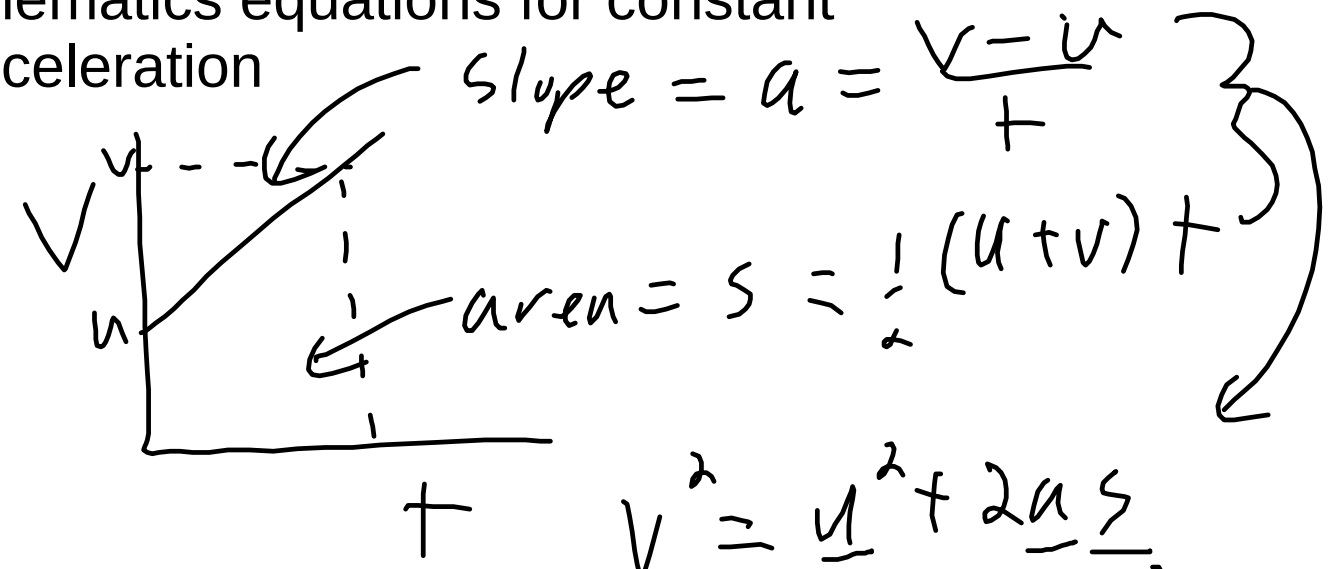
simple kinematics

$v=\Delta x/\Delta t$ slope of a s-t graph

$a=\Delta v/\Delta t = \Delta^2 x/\Delta^2 t$ slope of the v-t graph

area under the v-t graph is s

kinematics equations for constant acceleration



$$v^2 = u^2 + 2as$$

$$s = ut + \frac{1}{2}at^2$$

eg. 1. A racing car is moving at 20.0 m/s and slows to 15.0 m/s. What is the acceleration if

a) it takes 3.0s to slow?

H:

$$a = \frac{v-u}{t} = \frac{15 - 20}{3}$$

$$= -1.6\overline{6} \rightarrow 1.7$$

a) it slows over 10.0 m.

$$a = \frac{v^2 - u^2}{} = \frac{5^2 - 20^2}{}$$

$a = \frac{v - u}{2s} = \frac{15 - 400}{2(10)}$

$=$

$=$

((15x15)-(400))/20=-8.75 m/s^2

2. You throw a ball up at 8.0 m/s from a height of 30.0m.

a) how far up does it go?

$-v^2 = 2as \quad s = \frac{-u^2}{2a} = \frac{-(8.0\,m/s)^2}{2(-9.81\,m/s^2)} = 3.26\,m$

3.26 m

~~a~~) how fast does it hit the ground?

b) $v^2 = u^2 + 2as \rightarrow 8^2 + 2(-9.8)(-30)$

30+3.27 m

~~$(0\,m/s)^2$~~

$v^2 = (0\,m/s)^2 + 2(-9.8\,m/s^2)(-33.27\,m)$

$= 652.092$

$v = \pm\sqrt{652.092}$

$= \pm 25.54\,m/s$ (reject +)

$= \pm 25.54$ m/s (reject +)

-25 m/s

a) how much time does it take to hit the ground?

$ax^2 + bx + c = 0 \quad x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$

p39 problem 17, 23, 27, 37, 42, 44, 45

$s = ut + \frac{1}{2}at^2$

$-30 = 8t + \frac{(-9.8)}{2}t^2$

$0 = -4.9t^2 + 8t + 30$

$t = \frac{-8 \pm \sqrt{8^2 - 4(-4.9)(30)}}{2(-4.9)}$

$t = \frac{-8 \pm 25.534}{-9.8} = 3.425$

next class adding vectors
using

scale diagram
cosine law
components